to limit the flame temperature. Technology directed toward overcoming these difficulties in order to achieve efficient and low-emission operation of thermal engines is described, for example, in U.S. Pat. No. 6,062,023 (Kerwin, et al.) issued May 16, 2000, and incorporated herein by reference.

[0680] External combustion engines are, additionally, conducive to the use of a wide variety of fuels, including those most available under particular local circumstances; however the teachings of the present description are not limited to such engines, and internal combustion engines are also within the scope of the current disclosure. Internal combustion engines, however, impose difficulties due to the typically polluted nature of the exhausted gases, and external combustion engines are preferably employed.

[0681] Still referring to FIG. **72**A, an embodiment of a power unit **528010** is shown schematically in FIG. **72**B. Power unit **528010** includes an external combustion engine **528101** coupled to a generator **528102**. In an exemplary embodiment, the external combustion engine **528101** is a Stirling cycle engine. The outputs of the Stirling cycle engine **528101** during operation include both mechanical energy and residual heat energy. Heat produced in the combustion of a fuel in a burner **528104** is applied as an input to the Stirling cycle engine **528101**, and partially converted to mechanical energy. The unconverted heat or thermal energy accounts for approximately 65 to 85% of the energy released in the burner **528104**. The ranges given herein are approximations and the ranges may vary depending on the embodiment of water vapor distillation apparatus used in the system and the embodiment of the Stirling engine (or other generator) used in the system.

[0682] This heat is available to provide heating to the local environment around the power unit **528110** in two forms: a smaller flow of exhaust gas from the burner **528104** and a much larger flow of heat rejected at the cooler **528103** of the Stirling engine. Power unit **528110** may also be referred to as an auxiliary power unit (APU). The exhaust gases are relatively hot, typically 100 to 300° C., and represent 10 to 20% of the thermal energy produced by the Stirling engine **528101**. The cooler rejects 80 to 90% of the thermal energy at 10 to 20° C. above the ambient temperature. The heat is rejected to either a flow of water or, more typically, to the air via a radiator **528107**. Stirling cycle engine **528101** is preferably of a size such that power unit **528010** is transportable.

[0683] As shown in FIG. **72**B, Stirling engine **528101** is powered directly by a heat source such as burner **528104**. Burner **528104** combusts a fuel to produce hot exhaust gases which are used to drive the Stirling engine **528101**. A burner control unit **528109** is coupled to the burner **528104** and a fuel canister **528110**. Burner control unit **528109** delivers a fuel from the fuel canister **528110** to the burner **528104**. The burner controller **528109** also delivers a measured amount of air to the burner **528104** to advantageously ensure substantially complete combustion. The fuel combusted by burner **528104** is preferably a clean burning and commercially available fuel such as propane. A clean burning fuel is a fuel that does not contain large amounts of contaminants, the most important being sulfur. Natural gas, ethane, propane, butane, ethanol, methanol and liquefied petroleum gas ("LPG") are all clean burning fuels when the contaminants are limited to a few percent. One example of a commercially available propane fuel is HD-5, an industry grade defined by the Society of Automotive Engineers and available from Bernzomatic. In accordance with an embodiment of the system, and as discussed in more detail below, the

[0684] Stirling engine **528101** and burner **528104** provide substantially complete combustion in order to provide high thermal efficiency as well as low emissions. The characteristics of high efficiency and low emissions may advantageously allow use of power unit **528010** indoors.

[0685] Generator **528102** is coupled to a crankshaft (not shown) of Stirling engine **528101**. It should be understood to one of ordinary skill in the art that the term generator encompasses the class of electric machines such as generators wherein mechanical energy is converted to electrical energy or motors wherein electrical energy is converted to mechanical energy. The generator **528102** is preferably a permanent magnet brushless motor. A rechargeable battery **528113** provides starting power for the power unit **528010** as well as direct current ("DC") power to a DC power output **528112**. In a further embodiment, APU **528010** also advantageously provides alternating current ("AC") power to an AC power output **528114**. An inverter **528116** is coupled to the battery **528113** in order to convert the DC power produced by battery **528113** to AC power. In the embodiment shown in FIG. **72**B, the battery **528113**, inverter **528116** and AC power output **528114** are disposed within an enclosure **528120**.

[0686] Utilization of the exhaust gas generated in the operation of power unit **528010** is now described with reference to the schematic depiction of an embodiment of the system shown in FIG. **72**C. Burner exhaust is directed through a heat conduit **528016** into enclosure **528504** of the water vapor distillation apparatus unit designated generally by numeral **528012**. Heat conduit **528016** is preferably a hose that may be plastic or corrugated metal surrounded by insulation, however all means of conveying exhaust heat from power unit **528010** to water purification unit **528012** are within the scope of the system. The exhaust gas, designated by arrow **528502**, blows across a heat exchanger **528506** (in the exemplary embodiment, a hose-in-hose heat exchanger is used, in other embodiments, a finned heat exchanger is used), thereby heating the source water stream **528508** as it travels to the water vapor distillation (which is also referred to herein as a "still") evaporator **528510**. The hot gas **528512** that fills the volume surrounded by insulated enclosure **528504** essentially removes all thermal loss from the still system since the gas temperature within the insulated cavity is hotter than surface **528514** of the still itself. Thus, there is substantially no heat flow from the still to the ambient environment, and losses on the order of 75 W for a still of 10 gallon/hour capacity are thereby recovered. A microswitch **528518** senses the connection of hose **528016** coupling hot exhaust to purification unit **528012** so that operation of the unit may account for the influx of hot gas.

[0687] In accordance with alternate embodiments adding heat to exhaust stream **528502** is within the scope of the system, whether through addition of a post-burner (not shown) or using electrical power for ohmic heating.

[0688] During initial startup of the system, power unit **528010** is activated, providing both electrical power and hot exhaust. Warm-up of the still **528012** is significantly accelerated since the heat exchanger **528506** is initially below the dew point of the moisture content of the exhaust, since the exhaust contains water as a primary combustion product. The heat of vaporization of this water content is available to heat source water as the water condenses on the fins of the